CUTEC News

FIT FOR THE FUTURE

EDITORIAL

CUTEC 2020 – FIT FOR THE FUTURE

Dear Readers,

In the last issue of CUTEC News, we outlined a roadmap which will take us to the sustainable industrial society. Put succinctly, power generation which is largely based on renewables will be needed over the long term along with nearly complete recycling of finite resources.

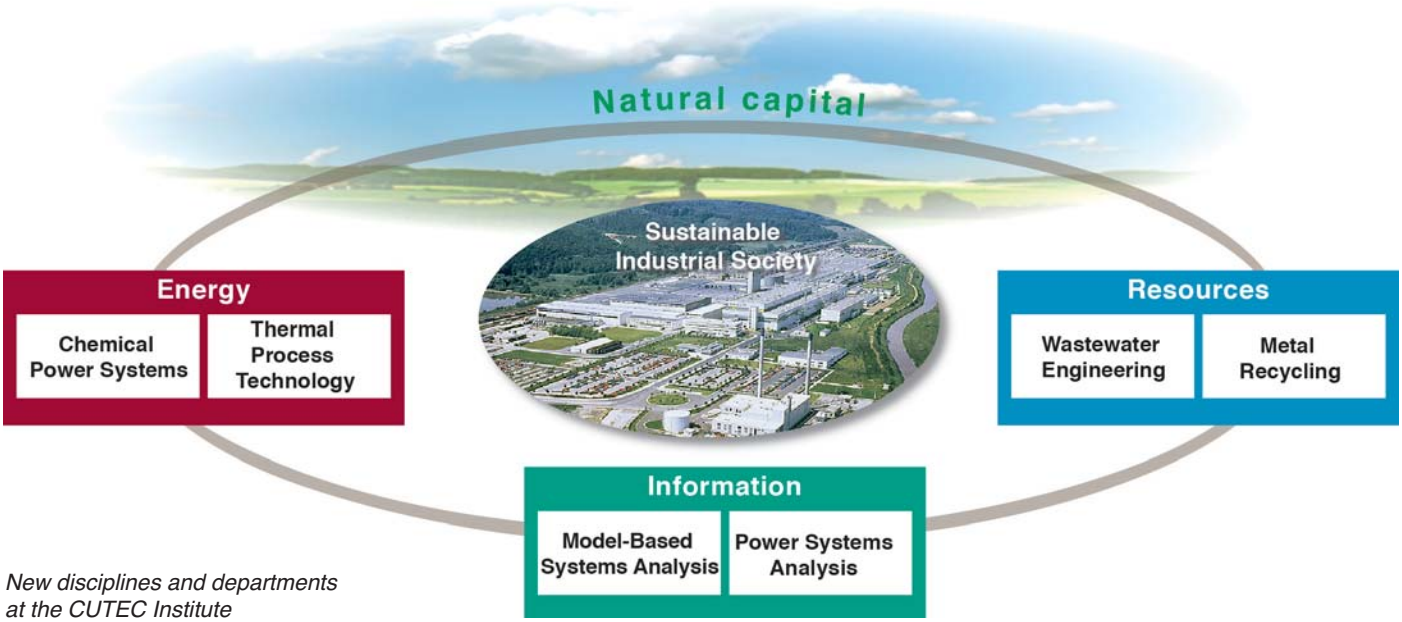
It is not our intention, however, to work only at the conceptual level. We want to make a tangible contribution which will help make these visions a reality. In recent months, we have been working intensively on the CUTEC 2020 strategy and we have discussed the strategy with the Scientific Advisory Board. The results are shown in the small illustration.

The strategy is of course based on the wide range of expertise and wealth of experience which we have in our six R&D departments. To make the sustainable industrial society a reality, we first need science-based system analysis to obtain reliable information. In the field of resources and energy, we can then offer you cutting-edge technologies at the interface between the academic and industrial sectors.

We hope that our clearly structured organisation, sharper profile, customer-orientated department names and corporate design will make us fit for the future. We invite you to visit our homepage, or even better pay us a visit to find out more.

In the meantime, I wish you a pleasant summer,

Martin Faulstich



New disciplines and departments at the CUTEC Institute

REPRESENTING CUTEC ON THE ROAD

46TH ESSEN CONFERENCE

Photo: Dipl.-Designer S. Rauh

Prof. Faulstich presented the 2012 environmental report during his talk

The Essen Water and Waste Management Conference is now an institution. Nearly a thousand participants make their way to Essen or Aachen every year to attend an event which has attracted water and wastewater experts for nearly 50 years. Current and future developments in the world of politics, science and practical application are presented and discussed at the conference.

The headline theme this year on March 13th – 15th was resource protection as an interdisciplinary undertaking. Prof. Ernst-Ulrich von Weizsäcker and Prof. Martin Faulstich gave the opening talks. Prof. Faulstich shared information on the current environmental report entitled "Responsibility in a Finite World" generated by the German Advisory Council on the Environment (SRU).

To an increasing extent, the central issue of ecological constraint will dominate the environmental policy debate. Unlimited demand for natural resources is not sustainable in a finite world. Future economic sustainability will depend on our ability to break the dependency between affluence and resource consumption through ground-breaking innovation and a willingness to give greater recognition to ecosystem achievements which are vital for our survival. SRU consciously limited itself to a few major issues where in its view more action or better guidance is needed or where major ground-breaking decision points will soon be reached. (he)

25TH KASSEL WASTE FORUM

This was an anniversary year for the Kassel Waste Forum which was held on April16th – 18th. As was the case in recent years, this major conference attracted nearly a thousand participants. The conference is without doubt a flagship industry event in the German-speaking region.

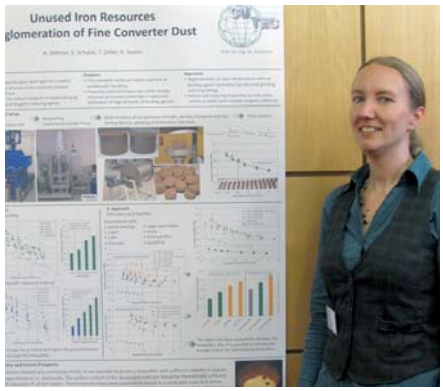
As always, trade associations from the private and public municipal waste and resource industry outlined their positions. The plenary talks were given by Prof. Martin Faulstich (Responsibility in a Finite World), Prof. Claudia Kempfert (The Economic Opportunities of a Wise Energy Transition) and Dr. Gottfried Jung (Economic Sustainability Through Recycling – Where are We Today and Where Do We Want to Be Tomorrow?).

The 25th anniversary was naturally a milestone worth celebrating. With his informative and enjoyable style, Prof. Faulstich acted as Master of Ceremonies. Prof. Klaus Wiemer got the journey back through time underway by reflecting on the period 1990 –1995 (waste crisis, packaging glut and the disposal site era). Next came Prof. Klaus Fricke (1996 - 2000 – biowaste collection and separate collection) followed by Thomas Grundmann (2001 - 2005 – urban waste directive and mechanical-biological waste treatment) and Prof. Klaus Wiemer (2006 to the present – climate protection and the recycling society). The Kassel Chamber Orchestra provided the excellent musical accompaniment. The event was most enjoyable. The only downside was the fact that co-organiser Dr. Michael Kern was unable to attend due to illness. (he)

Photo: Witzenhausen-Institut GmbH

A large audience listened attentively to the talks given by the experts

ERA-MIN ROADMAP CONFERENCE IN PORTUGAL



Anne Dittmar showed a poster on the project for agglomeration of fine converter dust

In March 2013, we had the opportunity to make a poster presentation at the ERA-MIN Roadmap Conference in Carcavelos, Portugal. ERA-MIN receives funding from the 7th EU Framework Programme for Research to improve the coordination of research activities by EU member states in the field of non-energy raw materials. The programme receives German support from the Federal Ministry of Education and Research (BMBF) and the Jülich Research Centre. Five groups (primary resource extraction, recycling, substitution, data acquisition and research and education) generated an initial version of the roadmap last year and presented the roadmap to the research community at the conference. On the first day, speakers from the entire value-added chain gave presentations on activities such as mining projects for rare earth minerals in Portugal and Sweden, new modelling tools for ground exploration and the recycling of rare earth minerals. The provisional roadmap was then presented, and on the second and third days various working groups reviewed and discussed the roadmap and made changes and enhancements where necessary. Concrete examples relating to roadmap goals were shown in the poster presentation which took place in parallel. Anne Dittmar was at the conference on behalf of CUTEC. She put up a poster on the project for agglomeration of fine converter dust and participated in the Recycling Working Group. (dm)

ENERGY BEETS – AN ATTRACTIVE ALTERNATIVE SUBSTRATE FOR BIOGAS PRODUCTION

Production of biogas from renewable resources has increased considerably in recent years. Maize is currently the preferred substrate, and that has resulted in a considerable expansion of maize acreage in Germany. A debate has ensued with claims being made that maize is "taking over" the countryside. There is also the issue of crop rotation to avoid plant disease and pest infestation. Consequently, the search is on for alternative high yield biogas substrates. In addition, broadening the resource base will give biogas plant operators more options and reduce their susceptibility to fluctuating agricultural prices.

High yields per acre and good fermentation activity make sugar beets a promising alternative. In established beet cultivation regions, biogas producers have been using beets for many years as a supplemental substrate. Despite the practical knowledge which already exists, further research into breeding, processing and preservation will be needed to make energy beets competitive as a biogas substrate on a broad scale.

CUTEC is part of a research consortium which also includes KWS Saat, INPUT and the German Biomass Research Centre (DBFZ). The researchers are looking at the entire process flow for the production of biogas from sugar beets, starting with plant breeding and continuing right through to biogas upgrading and distribution. The funding is provided by the German Ministry of Food, Agriculture and Consumer Protection and is channelled through the Renewable Resources Agency. The consortium has been given the task of developing breeding strategies and exploring opportunities for technical optimisation to support production of biomethane in Germany which is price competitive with natural gas. The project has a lifetime of 3 years (06/2010 – 06/2013). Particular emphasis is being placed on the development and appraisal of modified breeding strategies as well as technical optimisation potential and factors which can reduce the cost of individual processing steps and process stages. The project will hopefully provide answers to the following question: to what extent can all of the identified breeding, engineering, process biology and economic factors acting together produce advantages in the real-world production of biogas from sugar beets?

During the project, KWS performed hand crossing over three vegetation periods using divergent breeding material from a gene pool of existing animal feed and sugar beet species. Plot trials were carried out on the beta beet hybrids at three different sites to appraise crop performance. Analysis of the results so far indicates that the genetic make-up of the beet roots is very well suited for biogas production. However, it is likely that future crossing with high-performance genotypes which have limited potential for sugar production may result in further enhancement to biogas beet species.

CUTEC carried out extensive fermentation trials using the sample material from the plot trials to determine biogas yield potential and process stability for mono fermentation with high volumetric loading. Gas measurement cells that were developed in house and lab fermenters which have been in continuous use for more than 2 years (see illustration) were used to conduct the trials. The variation in specific gas yields between the species under investigation was relatively low, and the biogas formation rate tended to rise as the sugar content increased. Supplementation trials showed that by adding certain nutrients it was possible to significantly improve process stability during mono fermentation of beets. In parallel with the trials, modified computer-based process models and simulation are helping to identify opportunities to optimise fermentation.

Another important aspect of the trials was the selection of suitable preservation methods and the determination of silage losses. Even with good preservation, rapid sugar breakdown causes up to 20% loss of dry organic mass. However the resulting decrease in potential biogas yields was relatively modest, because compounds with substantially higher energy content are formed during ensilage. Based on these results as well as the experience gained during engineering work carried out by INPUT and KWS and economic modelling performed at DBFZ, there are clear indications that in addition to the breeding and process biology aspects, additional opportunities for optimisation exist in the interaction between the individual cleaning-storage-fermentation steps in the overall processing chain. A project report will be published towards the end of this year. (bo)

Laboratory fermenter

REVIEW OF CEBIT 2013

CeBIT 2013 was a big success for the Modelling and Simulation Department (now Model-Based Systems Analysis). Many visitors showed an interest in the technology on exhibit for detecting dumped munitions on the sea bed. Most were interested in knowing when the system would be fully operational.

A large number of visitors visited the stand. Most were from foreign companies and universities. Some individuals in the technology transfer sector expressed an interest in the final product or in partnerships relating to the technology on exhibit or similar technology. The list of countries included Oman, Brazil, Poland and the Czech Republic.

In addition to the trade visitors, the Lower Saxony Environment Minister, the Permanent Secretary from the Lower Saxony Ministry of Science and Culture, the Mayor of the state capital Hannover and the Permanent Secretary for Technology in Brazil came to the stand to take a first-hand look at high-tech developed and tested in Clausthal.

Many other appointments were arranged at the stand as part of the Future Match initiative. A number of discussions took place on contamination caused by dumped munitions and poison gas in the North Sea and the Baltic and on the technology being developed to detect this contamination using neural networks and implicit modelling. (reu)

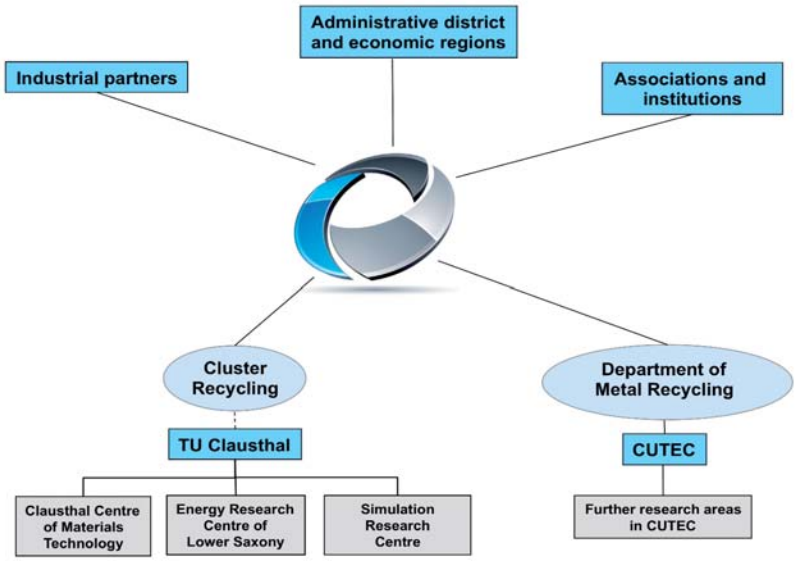
SECURING FUTURE SOURCES OF RAW MATERIALS: REWIMET – COLLECTIVE STRENGTH FOR THE BENEFIT OF THE HARZ REGION

The REWIMET association (Recycling cluster for economic strategic metals in Lower Saxony), founded on October 19th 2011 in the presence of former Lower Saxony Minister of Economics Mr. Jörg Bode, has attracted a significant number of new members within one and a half years. 29 companies and organisations are now injecting new impulses into metal recycling in the Harz region. They are committed to enhanced raw material supply security, environmental protection and employment. CUTEC is one of the highly motivated founding members.

The cluster brings together private sector companies, research institutions, trade associations, local authorities and other institutions. In the Harz region, this concentration of resources in the field of metal recycling is unique in Germany. (Figure on the right top). Leading recycling companies have a deep knowledge of metals. Clausthal University of Technology (TU Clausthal) has outstanding research and technology expertise. The application-oriented CUTEC Institute is operating successfully in advanced development for industrial implementations.

The declared goal of REWIMET is to develop recycling strategies and technologies for economic strategic metals such as germanium, gallium, indium and rhenium for the purpose of recovering these raw materials from waste. The underlying vision is to sever the link between economic growth and the import of economic strategic metals. The consortium wants to close known gaps in the value-added chain within harmonised recycling methods with product and materials development. Through innovative approach like material flow logistics and process development, REWIMET will contribute to increase essential resources and energy efficiency.

REWIMET defined its research strategy along the process chain in 2012 and formed working groups (WGs) based on the interests and needs of those involved. The WGs will develop specific project proposals. CUTEC has taken responsibility for research coordination. Dr. Torsten Zeller from CUTEC and Prof. Dr. Heike Schenk-Mathes from TU Clausthal are in charge of Working Group 4 (Sustainability and Resource Efficiency). Dr. Zeller is also heavily involved in project initiation and definition. Mr. Arndt Bachmann from CUTEC is currently working on a research proposal to investigate the recycling of mining tailings for recovering valuable metals.



Structure and integration of the partners in the REWIMET cluster

As a member of the REWIMET cluster, CUTEC is currently involved in discussions with Lower Saxony Minister President Stephan Weil on the establishment of a secondary raw material centre. CUTEC and TU Clausthal have created the concept plan which will boost the economy in South-eastern Lower Saxony for a long term and counteract the negative trend caused by structural change. Regional development is a specific priority for Minister President Weil and he believes that sound knowledge in raw material can be a progressive advantage.

At just the right time, the European Union has set new priorities for ERDF (European Regional Development Fund) covering the upcoming period (2014-2020). The recycling industry is among those priorities, giving CUTEC and REWIMET additional potential source of funding.

REWIMET is a successful project of IZH (Future for Harz Initiative). Dr. Reimund Westphal, former Managing Director of Recylex, Oker, and Prof. Daniel Goldmann from TU Clausthal are the chairmen of the cluster's Management Board. Thomas Kruckow is the cluster manager. Dr. Britta Kragert from CUTEC is the research coordinator. The cluster has its head office in Goslar and a branch office in Clausthal-Zellerfeld.

The Lower Saxony Ministry of Economics is currently providing funding for a period of two years to support the cluster during the initial phase.

More information on REWIMET's activities is available at www.rewimet.de.

REWIMET is an open public-private partnership which focuses on growth. The cluster offers opportunities for partnerships from recycling technology to information management and as well the logistics chain.

Are you interested? New network partners are most welcome. (kra)

20TH SME INNOVATION DAY IN BERLIN

On May 16th 2013, the CUTEC Institute together with its project partner, the Fuel Cell Research Centre (ZBT) in Duisburg, made an appearance at the 20th SME Innovation Day sponsored by the German Ministry of Economics (BMWi). At the AiF Projekt open-air exhibition ground, the partners showed their high-efficiency propane-fuelled SOFC system from the AAGR Project (see CUTEC News 3/2010).

More than 300 companies, research institutions and collaboration networks from across Germany were there on the day to present the results from a broad spectrum of BMWi-funded R&D projects. (di)

REVIEW OF THE REWIMET SYMPOSIUM IN GOSLAR

The REWIMET recycling cluster staged its first symposium on recycling expertise to enhance the security of supply for strategic metals. The event took place on April 24th at the energy research centre (EFZN) in Goslar. The very informative talks addressed current issues relating to the contribution which recycling can make to raw material supply security, environmental protection and the role of the region.

The Chairmen of the recycling cluster Dr. Westphal and Prof. Goldmann acted as moderators at the event and put together an agenda which covered a broad range. There were speakers from the public sector (Lower Saxony Ministry of the Environment and Climate Protection), the private sector (RA Rohstoffallianz, Volkswagen, Elektrocycling, Aurubis, H.C. Starck and Recylex) and the scientific and research community (TU Clausthal and the CUTEC Institute). The talks covered a lot of ground and gave the audience a broad, in-depth insight into the activities, needs, challenges and approaches for the recycling of strategic metals.

Photo: Schenk, Goslarsche Zeitung

CUTEC Managing Director Prof. Martin Faulstich during his talk

Two speakers from CUTEC were at the symposium. In his opening talk, CUTEC Managing Director and Chairman of the German Advisory Council on the Environment (SRU) Dr. Martin Faulstich spoke about metal and mineral resources from the vantage point of SRU. SRU advocates the concept of the sustainable industrial society. Through its direct contacts with the Ministry of the Environment, it is able to garner support at the highest political level and help the REWIMET recycling cluster achieve its goals. This will enhance and solidify the position and importance of the recycling cluster at the national level.

The second talk was given by Andreas Sauter from the Sustainability Management Department (now Metal Recycling). He spoke about resource efficiency for metal resources based on closed-loop recycling. He shared information on two projects in particular, namely zinc recovery from steel scrap and innovative processing and agglomeration of metallurgical residue. Both projects make a significant contribution. Process substitution and exploitation of urban mining opportunities can substantially boost resource efficiency and cut CO_2 emissions.

It is fair to say that the symposium on recycling of strategic metals addresses the issues at a depth and breadth which is probably unparalleled in Germany. In the interest of this important endeavour and everyone involved, we hope that the REWIMET recycling cluster will organise and stage many more events of this kind in the future. (sr)

Prof. Dr.-Ing. Marcus Grünewald

SCIENTIFIC ADVISORY BOARD:

A profile of Dr. Marcus Grünewald

Prof. Grünewald has been Professor of Fluid Process Engineering at Ruhr University in Bochum since 2009, and he joined the Scientific Advisory Board at CUTEC in 2011. He began his academic career in 1989 at the age of 20 when he enrolled as a chemical engineering student at the University of Dortmund. He received his diploma in 1995. For the next 5 years, Prof. Grünewald worked as a research assistant in the Systems Engineering Department and wrote his doctoral thesis on “multi-stage fluidized beds with dual-flow gratings for continuous counter-flow adsorption – investigations into fluid dynamics”. After obtaining his doctoral degree in 2000, he worked initially for four years as Senior Engineer in the Department of Technical Chemistry B at the University of Dortmund where he was in charge of the multi-functional catalyst working group. After leaving the university, he began working at Bayer Technology Services in Leverkusen. During the five years he worked in industry, he developed modular equipment and process technology but also remained committed to his previous research on multi-functional catalysts and he wrote a professorial dissertation on this topic. In 2009, Prof. Grünewald returned to the university in Bochum and as mentioned above was appointed Chairman of the Fluid Process Engineering Department at the Thermal and Fluid Dynamics Institute. He is also the Director of the Institute. His research is concentrated on micro-process technology, micro equipment and system design, absorption and distillation and the analysis of multi-phase equipment with the aid of non-invasive measurement techniques. In his teaching capacity, he invests a lot of effort in his areas of specialisation and also acts as coordinator for the environmental engineering and resource management course of studies. When asked about what motivates him to dedicate his time to the CUTEC Scientific Advisory Board, Prof. Grünewald said the following: “Despite the fact that the engineering community has little influence on the way resources are distributed around the world, optimal utilisation of the resources which are available represents one of the greatest challenges for future generations of engineers. Neither the ideal selection and design of a reactor nor the energy-efficient design of individual separation processes will produce the desired outcome. There can be no doubt about that. Instead, a holistic approach inspired by innovative ideas along with planning and implementation carried out with a sense of proportion based on experience will be vital. In my view, CUTEC is committed to this approach, and it is a pleasure for me to accompany CUTEC on its journey to exciting new innovations.” (he)

HMI (HANNOVER MESSE INDUSTRIE) REVIEW

CUTEC makes an appearance at the Energy show

CUTEC presentet itself on the corporate stand „Energy from Lower Saxony“ at the world's leading industrial trade show. Using the slogan “You know our horses - now experience our power” 20 companies, research institutions and universities put on a demonstration of their expertise in the field of energy technology.

CUTEC has been intensely researching on SOFC-based fuel cells for almost 10 years, with the main focus on maximization of electrical system efficiency by using enhanced components as well as intelligent design and interacting of the individual process stages.

CUTEC presented two SOFC systems at the stand this year. The first is an SOFC system with anode gas recycling for high efficiend electrical conversion of propane to electricity. The other is an autonomous, highly thermal integrated propane-based system in low-power range.

Lower Saxony Minister of Science and Culture Dr. Gabriele Heinen-Kljajić talking with Dr.-Ing. Raph-Uwe Dietrich

Numerous visitors came to the CUTEC stand looking for general information on SOFC fuel cells and many were interested in the current status of research carried out at CUTEC. Dr. Ralph-Uwe Dietrich welcomed Lower Saxony Minister for Science and Culture Dr. Gabriele Heinen-Kljajić at the stand.

Jana Oelze, Dr. Andreas Lindermeir, Christian Szepanski and Christoph Immisch who were also part of the exibition team answered expert questions and took part in discussions on the energy transition. Many research project partners, from both the research and industrial sectors, welcomed the opportunity to take a first-hand look at the completed systems.

Products from a number of companies were installed on the CUTEC display items, and CUTEC was able to intensify its contacts with these companies. Positive feedback and commitments of support will contribute to the development of future research and pilot systems. (im)

NEW ADDITIONS TO THE CUTEC TEAM

Dr Nina Roth joined CUTEC on April 22nd, 2013, taking up the newly created post of Scientific Executive Management Assistant.

Dr Roth studied chemistry in Braunschweig and Göttingen. After receiving her diploma, she continued her studies at the Chemnitz University of Technology where she obtained a doctoral degree in inorganic chemistry. She wrote her thesis on the synthesis and characterisation of copper and ruthenium precursors and how they can be used to remove metal coatings based on the CVD technique.

For private reasons, she and her husband moved to Schleswig-Holstein after she received her doctoral degree. While working at the Federal Employment Agency (BA) there, she acquired extensive administrative skills which she will now put to good use in her new role. (he)

Dr. Nina Roth at work

REPORT FROM THE WORKERS COUNCIL

The Workers Council had its first monthly meeting with new Managing Director Prof. Martin Faulstich on February 27th, 2013. The seven members of the Workers Council along with Mr. Sommer and Dr. Vodegel from the Senior Management Team attended the meeting. The atmosphere at the meeting was very positive. The Workers Council gave a presentation outlining the main emphasis of its previous work and specifically addressed the bargaining agreements. Prof. Faulstich acknowledged the agreements and they remain in force. It is important for Prof. Faulstich that CUTEC continues to provide professional and vocational training. Continued development opportunities for young scientists, for example doctoral programmes, are one of his priorities. Prof. Faulstich initially rejected a planned time and attendance recording agreement. There will be one principle agenda item for each of the monthly meetings. Prof. Faulstich stated that “everyone should enjoy coming to work”. (kf)

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Published by:
CUTEC Institut
Editor: Dr. T. Heere (he)
Contributors:
Dipl.-Ing. H. Bormann (bo)
Dr.-Ing. R.-U. Dietrich (di)
Dipl.-Ing. A. Dittmar (dm)
Prof. Dr.-Ing. M. Faulstich (fa)
Dr. T. Heere (he)
Dipl.-Ing. C. Immisch (im)
C. Kiefer (kf)
Dr.-Ing. B. Kragert (kra)
Prof. Dr.-Ing. M. Reuter (reu)
Dipl.-Kfm. A. Sauter (sr)
Layout and typesetting:
G. Wessels (wes)
Production and supply:
CUTEC Institut
Leibnizstr. 21+23
38678 Clausthal-Zellerfeld
Phone +49 5323 933-0
Fax +49 5323 933-100
E-Mail: cutec@cutec.de
Internet: www.cutec.de
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